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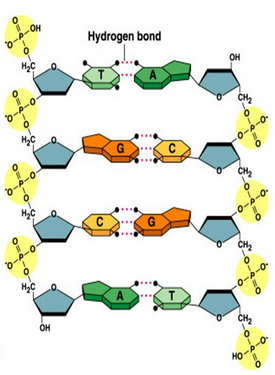
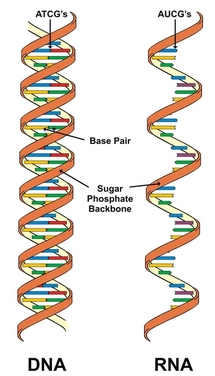
**Characteristics of Life Extension Activity – Are Viruses Alive?**

Pre-AP Biology, Mrs. Krouse, 2015-2016

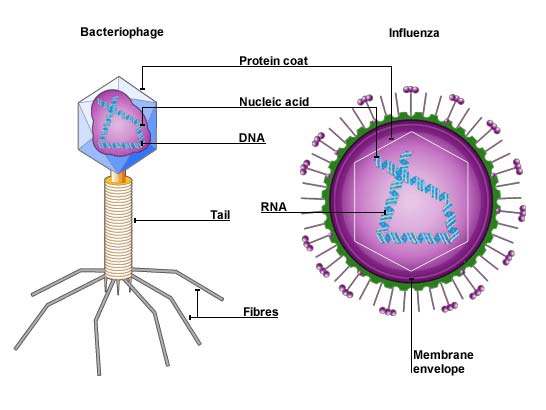
**Background Information:** For years, scientists have debated whether or not viruses should be considered alive. Viruses include disease-causing agents in humans such as influenza, rhinovirus (the cold virus), and HIV (human immunodeficiency virus). Viruses are made of two molecules commonly found in the cells of living things—protein and genetic material. Genetic material is passed from parents to offspring and determines the traits of the parent(s) and offspring. Not all viruses contain DNA as their genetic material. Instead, some viruses contain a molecule similar to DNA called RNA. The structures of the DNA and RNA molecules are shown side-by-side below and to the right. The structures of the DNA and RNA molecules are also compared in the next two paragraphs.

DNA’s structure is often called a “double helix” because it looks like a twisted ladder. The sides of the ladder are made of alternating sugars and phosphate groups. The image below and to the left shows an untwisted DNA double helix with its circular phosphate groups and pentagonal (5-sided) sugars shown alternating in the sides of the ladder. The image below and to the right , in contrast, does not show this much detail. The actual sugars and phosphate groups are not displayed. The RNA molecule also has a sugar and phosphate backbone, though it does not have two like the DNA molecule.

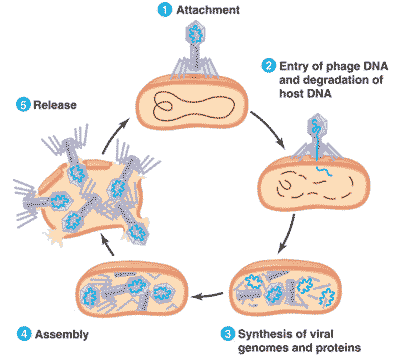
The rungs of the DNA ladder (i.e. the middle parts where you would place your foot if you were climbing the ladder) are made of molecules called nitrogen bases. There are four types of nitrogen bases in the DNA molecule—adenine (A), thymine (T), cytosine (C), and guanine (G). The nitrogen base attached to one side of the ladder matches with a partner nitrogen base attached to the other side of the ladder using a weak connection called a hydrogen bond. Adenine always matches with thymine across the double helix, and guanine always matches with cytosine across the double helix (see image below and to the left). RNA also contains nitrogen bases connected to its sugar-phosphate backbone, but these nitrogen bases do not have partner nitrogen bases and simply hang off the backbone. The nitrogen bases found in RNA are as follows—adenine (A), uracil (U), cytosine (C), and guanine (G). Thus, RNA contains the same nitrogen bases that are found in DNA, except it contains uracil (U) in place of thymine (T).

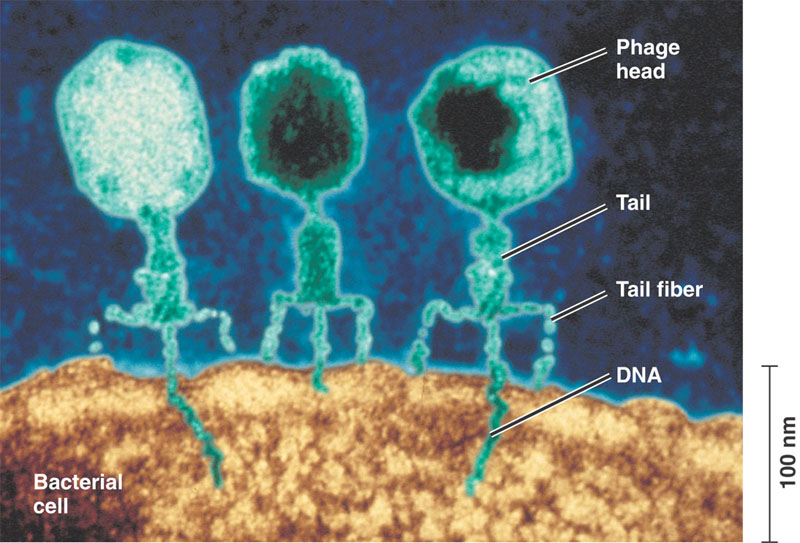


In viruses, an outer coating made of protein molecules typically surrounds and protects the genetic material (either DNA or RNA). Though viruses are made of some molecules typically found in cells (i.e. proteins and DNA /RNA), they do not contain all the essential parts of a typical cell. Two different types of viruses are shown in the image below. A bacteriophage (shown on the left) is a type of virus that only infects bacteria cells. Phage means “eater,” so bacteriophage literally means “bacteria eater.” The influenza virus (shown on the right) infects human cells and causes the common illness known as the flu. Even though these viruses look quite different, the picture below demonstrates that they have the same basic structure—a protein coat enclosing a nucleic acid (either DNA or RNA).



Viruses can reproduce and create offspring viruses, but they can only do so by infecting other organisms (ex: bacteria, plants, and animals). To infect the cells of other organisms, viruses use a needle-like structure that is part of their protein coat to inject their genetic material (either DNA or RNA) into the host cell. They then use the host cell’s tools to make baby viruses based on the parent virus’ genetic material. These baby viruses then burst out of the host cell, killing it in the process. The image below and to the right shows the infection process. The image below and to the left, which was taken by an electron microscope, shows a real bacteriophage infecting a bacterial cell





Viruses do not make or use energy molecules of their own. Instead, they use the energy molecules created by their host cell to provide energy for reproduction. Additionally, because they live inside a host cell, viruses do not need to respond to the environment or maintain stable internal conditions. The host cell does this for them.

Groups of viruses change over time. This is why you need a new flu shot every year. The population of influenza viruses changes enough every year that old vaccines will be ineffective against the traits displayed by the new viruses. Remember, vaccines are injections of medication that help prevent particular viral infections.

**Assignment Description:** In 8-10 sentences, use the evidence presented in the passage above and what you have learned about the characteristics of life to conclude whether or not viruses are living things. You must identify three pieces of evidence from the passage that support your conclusion and clearly explain HOW these pieces of evidence support your conclusion. You can cite specific phrases / sentences from the passage, but make sure to explain how they support your conclusion in your own words. Your response will be evaluated using the rubric given below.

|  |  |  |  |
| --- | --- | --- | --- |
| **Meets Expectations**  **(4 points)** | **Approaches Expectations**  **(3 points)** | **Needs Significant Improvement**  **(1-2 points)** | **Points Received** |
| \_\_\_\_ You have demonstrated a strong understanding of key concepts  \_\_\_\_ You clearly and thoroughly supported your claims with relevant evidence  \_\_\_\_You may have a couple small errors | \_\_\_\_You have demonstrated an understanding of some key concepts  \_\_\_\_You provided some relevant evidence, but did not clearly and thoroughly describe how it supported your claims  \_\_\_\_You have a couple significant errors | \_\_\_\_You have demonstrated an understanding of very few, if any, key concepts  \_\_\_\_The evidence you provided was not relevant  OR  \_\_\_\_You did not provide evidence  \_\_\_\_\_You have many significant errors |  |
| **Comments:** | | | |